BE Semester- VI (EC) Question Bank

(Digital Communication)

All questions carry equal marks (10 marks)

Q.1	Write the advantages of digital communication over analog communication.
Q.2	Explain delta modulation and demodulation technique.
Q.3	Write a short note on PCM and explain the role of compander in PCM.
Q.4	Represent 100111010 using following digital data format (1) Polar RZ (2) Bipolar NRZ (3) AMI NRZ (4) Split Phase Manchester (5) On-Off
Q.5	What is ISI? Explain Nyquist's frist criteria for zero ISI.
Q.6	Explain the desirable properties of line codes. What is essential bandwidth?
Q.7	Find the PSD of on-off signalling and discuss the advantages and disadvantages of on-off signalling.
Q.8	State and explain sampling theorem in detail. Also explain aliasing.
Q.9	A signal *m(t)* band-limited to 3 kHz is sampled at a rate 33.33% higher than the Nyquist rate. The maximum acceptable error in the sample amplitude is 0.5% of the peak amplitude m_p. The quantized samples are binary coded. Find the minimum bandwidth of a channel required to transmit the encoded binary signal. If 24 such signals are time-division multiplexed, determine the minimum transmission bandwidth required to transmit the multiplexed signal.
Q.10	State and explain central limit theorem in detail.
Q.11	Explain : (1) Auto-correlation (2) Probability density function.
Q.12	Define CDF. Prove all the properties of CDF.
Q.13	(a) A binary source generates digits 1 and 0 randomly with equal probability. Assign probabilities to the following events with respect to 10 digits generated by the source : (1) there are exactly two 1s and eight 0s. (2) there are at least four 0s. (b) Consider an AWGN channel with 4-kHz bandwidth and the noise power spectral density $\eta / 2 = 10^{-12}$ W/Hz. The signal power required at the receiver is 0.1 mW. Calculate the capacity of this channel.
Q.14	Define : mean, moment and variance of a random variable X.
Q.15	Define entropy. Show that the entropy is maximum when all messages are equiprobable.
Q.16	A source emits seven messages with probabilities 1/3, 1/3, 1/9, 1/9, 1/9, 1/27 and 1/27 respectively. Find the entropy of the source and compact binary code and also find the average length of the codeword. Determine the efficiency and redundancy of this code.
Q.17	Derive channel capacity of a binary symmetric channel.
Q.18	Discuss about error free communication over a noisy channel.
Q.19	A memoryless source emits six messages with probabilities 0.3, 0.25, 0.15, 0.12, 0.1 and 0.08. Find the 4-ary Huffman code. Determine its average word length, the efficiency and the redundancy.

Q.20	Construct a (7, 4) cyclic code using generator polynomial $g(x)=x^3+x^2+1$. Prepare a suitable decoding table. Decode the following received vectors: (a) 1101101 (b) 0101000.
Q.21	For a (6,3) code, the generator matrix G is $G=\begin{bmatrix}1&0&0&1&0&1\\0&1&0&0&1&1\\0&0&1&1&1&0\end{bmatrix}$ For all eight possible data words, find the corresponding codewords and verify that this code is a single correcting code.
Q.22	A binary channel matrix is given by $\begin{matrix}&&\textit{Outputs}\\&&y_1&y_2\\\textit{Inputs}&x_1&2/3&1/3\\&x_2&1/10&9/10\end{matrix}$ $P_x(x_1)$ = 1/3 and $P_x(x_2)$=2/3. Determine H(x), H(x|y), H(y), H(y|x) and I(x;y).
Q.23	"Hamming bound is a necessary but not sufficient condition for higher error correcting codes whereas is a necessary and sufficient condition for single error correcting codes". Justify.
Q.24	Describe the procedure of encoding and decoding of linear block codes.
Q.25	Explain viterbi decoding method for convolutional codes.
Q.26	Write a short note on burst error detecting and correcting codes.
Q.27	"When random variables are independent, they are uncorrelated. However the fact that they are uncorrelated does not ensure that they are independent". Justify.
Q.28	Write short notes on : (a) Regenerative repeaters (b) Eye diagram and its applications.
Q.29	Derive the expression for signal to quantization noise ratio in a PCM system.
Q.30	Explain QPSK with waveforms, constellation diagram and mathematical representation.
Q.31	Answer the following : (a) State the condition for orthogonality in case of signals. (b) Define a Gaussian random process. (c) What are the conditions for detecting and correcting errors upto 't' in a code word?
Q.32	State and explain Chebyshev's inequality.
Q.33	Explain the matched filter and correlation receiver for optimum threshold detection.
Q.34	Compare different types of signalling in terms of bit error probability for optimum binary detection.
Q.35	Derive the equation for bit error probability for optimum binary receiver.
Q.36	Explain non-coherent detection of ASK with required block diagram.
Q.37	Describe the exchange between the SNR and the transmission bandwidth using the channel capacity equation.
Q.38	Explain the concept of M-ary communication with suitable examples.
Q.39	Describe the carrier recovery and symbol synchronization in M-ary PSK receiver.
Q.40	Write a short note on differentially coherent FSK detection.